ARI Research Note 91-26

User's Manual: Distributed Training Technology Cost Analysis Templates (TTCATS)

Joseph D. Hagman
U.S. Army Research Institute

Dewey I. Dykstra, Jr.
Boise State University

Boise Element
Ruth H. Phelps, Chief

Field Unit at Fort Knox, Kentucky
Donald F. Haggard, Chief

Training Research Laboratory
Jack H. Hiller, Director

January 1991

United States Army
Research Institute for the Behavioral and Social Sciences

U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency Under the Jurisdiction of the Deputy Chief of Staff for Personnel

EDGAR M. JOHNSON
Technical Director

JON W. BLADES
COL, IN
Commanding

Research accomplished under contract
for the Department of the Army

Boise State University

Technical review by

Douglas MacPherson
Douglas Ramsay

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS --
2a. SECURITY CLASSIFICATION AUTHORITY --	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE --	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) --	5. MONITORING ORGANIZATION REPORT NUMBER(S) ARI Research Note 91-26
6a. NAME OF PERFORMING ORGANIZATION Boise State University 6b. OFFICE SYMBOL (If applicable) --	7a. NAME OF MONITORING ORGANIZATION U.S. Army Research Institute
6c. ADDRESS (City, State, and ZIP Code) 1910 University Drive Boise, Idaho 83725	7b. ADDRESS (City, State, and ZIP Code) 5001 Eisenhower Avenue Alexandria, VA 22333-5600
8a. NAME OF FUNDING/SPONSORING ORGANIZATION U.S. Army Research Institute for the Behavioral and Social Sciences 8b. OFFICE SYMBOL (If applicable) PERI-I	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER DE-AC07-76ID0157
8c. ADDRESS (City, State, and ZIP Code) 5001 Eisenhower Avenue Alexandria, VA 22333-5600	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. 63007A; PROJECT NO. 794; TASK NO. 516; WORK UNIT ACCESSION NO. C3

11. TITLE (Include Security Classification)
User's Manual: Distributed Training Technology Cost Analysis Templates (TTCATS)

12. PERSONAL AUTHOR(S)
Hagman, Joseph D. (ARI); and Dykstra, Dewey I., Jr. (Boise State University)

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM 87/02 TO 89/02	1991, January	39

16. SUPPLEMENTARY NOTATION This report was monitored by the Idaho National Engineering Laboratory, 785 DOE Place, Idaho Falls, Idaho 83402. Copies of the TTCATS software can be obtained from the following address: Chief, Army Research Institute, Boise, (Continued)

17. COSATI CODES		
FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Reserve component; Training technology; Distributed training; Decision support systems; Cost analysis

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This manual is a guide for the Training Technology Cost Analysis Templates (TTCATS) software program. TTCATS contains seven individual subprograms, or templates, that customize the LOTUS 1-2-3 spreadsheet to help project the cost of delivering training to geographically distributed locations. The cost estimates pertain either to delivery method and equipment configurations that have been independently determined to be appropriate for an anticipated application or to configurations recommended by a companion expert-system-based software program called TECHSELECT (See ARI Research Product 88-11).

The first six TTCATS templates calculate costs for a variety of distributed training delivery method and equipment configurations: asynchronous delivery via computer-based training with desktop microcomputers, asynchronous delivery via computer-based training with portable or laptop microcomputers, asynchronous delivery via computer conferencing, synchronous delivery via audio conferencing, synchronous delivery via video conferencing with land-based microwave communications, and synchronous delivery via video conferencing with (Continued)

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL
Joseph D. Hagman	(208) 334-9390	PERI-IKD

DD Form 1473, JUN 86 *Previous editions are obsolete.*

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

ARI Research Note 91-26

16. SUPPLEMENTARY NOTATION (Continued)

ATTN: PERI-IKD (Dr. Hagman), 1910 University Drive, Boise, Idaho 83725

19. ABSTRACT (Continued)

satellite-based communications. The last template calculates the cost of transporting trainees to a central training site.

Although TTCATS was developed to address the distributed training requirements of the U.S. Army National Guard and Reserve, its cost estimates apply generally to most nontraditional "classroom" situations in which trainees cannot meet at the same place for training.

FOREWORD

Limited time and wide geographical dispersion of units are two of the major training constraints encountered by the U.S. Army National Guard and Reserve, i.e., the Reserve Component (RC). In response to these constraints, the RC is considering the use of distributed training technology to deliver training to soldiers at convenient times and places, thereby reducing the effect of unit dispersion and ensuring that available training time is used effectively and efficiently to achieve maximum performance benefits.

The Distributed Training Technology Cost Analysis Templates (TTCATS) consists of seven computer-based, cost-analysis templates designed to assist the RC in projecting the costs of various distributed training technologies before making an implementation decision. The templates were developed by the Training Technology Field Activity, Gowen Field (TTFA-GF), whose mission is to improve the effectiveness and efficiency of RC training through the use of technology. The research task supporting this mission, "Application of Technology to Meet Reserve Component Needs," is organized under the "Maintain the Force" program area.

The National Guard Bureau (NGB), U.S. Army Training and Doctrine Command (TRADOC), and Idaho Army National Guard (IDARNG) sponsored development of this project under a Memorandum of Understanding, signed 12 June 1985, establishing the TTFA-GF. Product capabilities and required procedures have been presented to Chief, Training Support Branch, NGB; Director, Training Development and Analysis Directorate (TDAD), TRADOC; and the Assistant Adjutant General of Idaho. The product is being used by TRADOC and is under consideration for future Army-wide distribution.

ACKNOWLEDGMENTS

The following persons, listed alphabetically, contributed to the development of the Distributed Training Technology Cost Analysis Templates (TTCATS).

Colonel John Baker, Idaho Army National Guard (Ret.) and AT&T Communications
Mr. Joseph Duft, Training Consultant, Simplot/Micron Technology Center, Boise State University
Mr. Richard Graybeal, Chief Engineer, Simplot/Micron Technology Center, Boise State University
Mr. Ben Hambleton, Director, Simplot/Micron Technology Center, Boise State University
Mr. C. M. Merz, Professor of Accounting, Boise State University
Dr. Ruth Phelps, Chief, Army Research Institute, Boise Element
Dr. Rosalie Wells, Psychologist, Boise State University

USER'S MANUAL: DISTRIBUTED TRAINING TECHNOLOGY COST ANALYSIS TEMPLATES (TTCATS)

CONTENTS

USER'S MANUAL: DISTRIBUTED TRAINING TECHNOLOGY COST ANALYSIS TEMPLATES (TTCATS)

Chapter 1

THE NEED FOR TTCATS

Limited time and wide geographical dispersion of units are two of the major constraints encountered by the U.S. Army National Guard and Reserve, i.e., the Reserve Component (RC). To overcome these constraints, the RC is considering the use of distributed training technology to deliver training to its soldiers at convenient times and places, thereby reducing the effect of unit dispersion and ensuring that available training time is used effectively and efficiently to achieve maximum payoff.

To assist the RC in deciding which distributed training delivery method and equipment configurations would be most appropriate for its specific applications, an expert-system-based software program called TECHSELECT was developed (see ARI Research Product 88-11). In addition, a companion software program called TTCATS (short for Training Technology Cost Analysis Templates) has been developed to assist the RC in projecting the cost of particular delivery method and equipment configurations recommended by TECHSELECT.

TTCATS consists of seven individual subprograms, or templates, that customize the LOTUS® 1-2-3[1] spreadsheet to help project the cost of delivering training to distributed locations via different technological approaches, thereby providing an easy way to identify and compare the costs of different approaches prior to their actual selection and implementation. Some of the questions that can be answered with TTCATS include:

- What are the relative costs of using different technology configurations for delivering training to distributed sites?
- What distributed training cost factors need to be considered?
- How many trainees are needed at each training reception site to ensure a reasonable amortization rate of equipment costs?
- Would it be less expensive to transport trainees to the training site or deliver the training directly to their home stations, i.e., armories or training centers?

Although TTCATS was developed to answer these and other questions that pertain to the distributed training requirements of the RC, its cost estimates apply generally to most nontraditional "classroom" situations where trainees cannot meet at the same place for training. Resulting cost estimates, therefore, will help both military and nonmilitary training program planners in their attempts to provide the highest quality distributed training at the lowest possible cost.

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[1]LOTUS 1-2-3 is a registered trademark of Lotus Development Corporation

Cost Drivers

The primary cost drivers for distributed training are those associated with purchasing, installing, operating, and maintaining equipment as well as the costs for communications and software. The various templates contained in TTCATS are designed to calculate these kinds of costs. The templates will not, however, help you determine which distributed training technologies are most responsive to your needs (see ARI Research Product 88-11 for help in this regard) or most likely to be accepted by trainees, i.e., factors other than cost that will also impact your distributed training decisions.

Can Distributed Training Save Money?

One might wonder how the cost of implementing a new distributed training program might ever be less than that of continuing an existing resident "classroom-based" training program. Distributed training, for example, usually requires initial equipment purchase costs as well as recurring costs for maintenance and communication, neither of which typically apply to resident training. It does cost money, however, to bring trainees to school for resident training. This cost is relatively constant over the years and, if classrooms are filled, is more or less a fixed amount per trainee. The cost of distributed training, in contrast, is not fixed and depends on the number of trainees. As this number increases, the cost per trainee decreases, such that if enough trainees are involved, then distributed training can be less costly than resident training despite the equipment and communications costs associated with the former.

Figure 1 shows the cost per trainee for hypothetical resident and distributed training programs. If relatively few trainees participate in distributed training, then resident training is the less expensive alternative. As the number of trainees participating in distributed training increases, however, the difference in cost per trainee decreases such that both distributed and resident training costs are about the same at the cross-over point. As the number of trainees participating in distributed training increases beyond this point, distributed training becomes less costly than resident training.

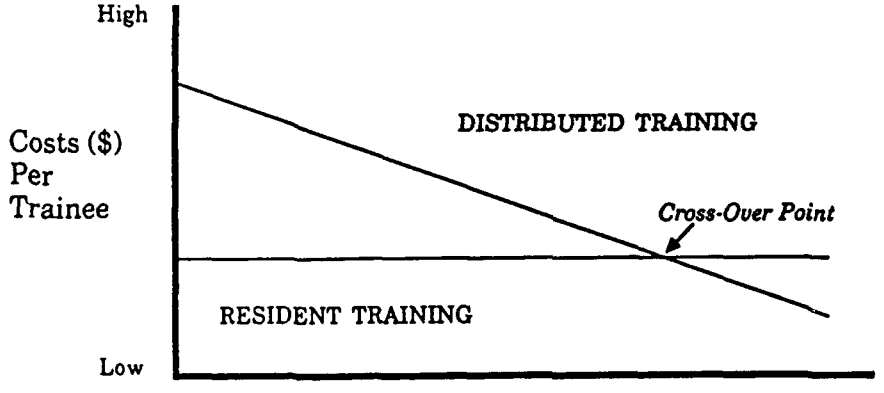

Figure 1. Resident and distributed training costs per trainee.

Although it probably would not pay to use distributed training when the number of trainees involved is insufficient to reach or surpass the cross-over point, once this point is reached, distributed training becomes an attractive option from the perspective of cost (Kearsley 1985). TTCATS will allow you to discover where the cross-over point exists for your particular situation and, in general, determine training program life-cycle costs (Kearsley, 1982).

ABOUT THIS MANUAL

This manual contains 8 chapters. Chapter 1, which you may have already read, discusses the need for TTCATS and describes its general capabilities. The present chapter previews the manual. Chapter 3 describes the specific templates contained within TTCATS and how they work. Chapter 4 lists the hardware and software needed to run TTCATS and describes the basic procedures to follow in getting started. Chapter 5 provides step-by-step guidance on how to use TTCATS' templates. Chapter 6 tells you how to print and save your results as well as how to exit from a template. Chapter 7 describes how to change the contents of template "cells," if necessary. And lastly, Chapter 8 tells how to view the formulas upon which cost calculations are based and lists some assumptions under which certain templates were developed.

ABOUT TTCATS

How is TTCATS Organized?

TTCATS contains seven templates: CATCBT, CATPORT, CATACC, CATAUD, CATMW, CATSAT, and CATTRAVL. The first 6 calculate distributed training costs for a variety of candidate delivery method and equipment configurations likely to satisfy most distributed training requirements.

These configurations are described in Appendix A and include:

1. Asynchronous delivery via computer-based training with "desktop" microcomputers (CATCBT),

2. Asynchronous delivery via computer-based training with portable or "laptop" microcomputers (CATPORT),

3. Asynchronous delivery via computer conferencing (CATACC),

4. Synchronous delivery via audio conferencing (CATAUD),

5. Synchronous delivery via video conferencing with land-based microwave communications (CATMW),

6. Synchronous delivery via video conferencing with satellite-based microwave communications (CATSAT).

The last template calculates the cost of bringing trainees to a central training site, i.e.,

7. Travel-related costs (CATTRAVL).

Each template includes (a) an INPUT SECTION where you enter your anticipated distributed training requirements, e.g., number of trainees, number of origination/reception sites, projected training schedule, and required communications equipment, (b) a DATA SECTION that contains prices for such things as equipment, software, communications, and maintenance, (c) a CALCULATION SECTION where information from the INPUT and DATA SECTIONS is manipulated via formula to derive projected costs for specific training-related line items, and (d) an OUTPUT SECTION that lists various cost-summary indices, e.g., dollars spent per trainee per training hour per year, as well as a breakdown of one-time, recurring, and usage costs. Both summary and breakdown costs are listed in the OUTPUT SECTION by year over a seven-year period.

How is TTCATS Used?

To use any of TTCATS' templates, you simply enter your anticipated distributed training requirements into the INPUT SECTION of the template that best matches the delivery method and equipment configuration you

consider to be most appropriate for your specific training application. If your distributed training requirements change, or if you would just like to explore different delivery and equipment configurations, then you can change your input accordingly and the selected template will calculate a new set of cost projections automatically. Thus, each template is flexible enough to calculate the estimated costs of your specific requirements as well as those of any alternative or "what if" requirements you might want to explore.

How Accurate are the Cost Data?

The cost data contained in each a template's DATA SECTION reflect institutional hardware and mail-order software prices as well as communications and travel fees in effect as of January 1988. Price or fee changes that have occurred since then can be updated using the template modification procedures described in Chapter 7.

Cost calculations do not reflect (a) site- or location-specific differences in fees for such things as broadcasting licenses and special purchases of equipment, e.g., Electronic Information Delivery System (EIDS), and (b) special arrangements for use of existing equipment, e.g., that owned by another organization or agency. To obtain the most accurate cost projections for your specific training application, you should update the DATA SECTION of the appropriate template with this information, if applicable (see Chapter 7). Each template was developed, however, under a common set of assumptions and price information to enable relative costs of different distributed training technology configurations to be determined when neither a nor b above apply.

What is a Spreadsheet?

As mentioned above, TTCATS' templates are LOTUS-based spreadsheets customized for the purpose of calculating the costs of various distributed training technologies. In general, spreadsheets simulate the use of a large sheet of accounting ledger paper that is divided into rows and columns to form boxes or cells. Each cell is identified by its row and column. For example, the cell located at the intersection of Column C and Row 47 is known as Cell C47.

Cells can contain labels, numbers, or formulas. Labels are strings of characters, usually letters, that identify the contents of a row, column, or neighboring cell. Numbers can be expressed in dollar, e.g., $47.00, percentage, e.g., 10%, or standard format, e.g., 23. Formulas indicate how to calculate a value to be displayed in a cell. A formula in Cell Q97, for example, might be "+(A47+G83)*F22" which means take the value in Cell A47 and add it to the value in Cell G83, then multiply the result by the value in Cell F22 and display the results in Cell Q97. If the content of any cell indicated in the formula is changed, then the value displayed in Cell Q97 will be recalculated automatically.

On your monitor screen you will see only a part (i.e., window) of the "ledger sheet" consisting of about 7 columns by 20 rows. Because each template contains more rows and columns than this, you can move the window

around (e.g., by using the arrow keys) to see the contents of cells that are out of view.

Spreadsheets let you set up a ledger-type relationship between quantities, allowing you to experiment with various input values and to determine, quickly and automatically, their effect on resulting calculations. Because of this capability, software spreadsheets are often referred to as "What if..." tools. The templates contained within TTCATS are just like spreadsheets and afford you the same capabilities. Although each template is LOTUS 1-2-3 based, no prior knowledge of LOTUS is required to use the templates. All you need to know is provided in this manual. Should you wish either to install LOTUS 123 on a hard disk prior to using a template or make major changes to a template's structure, however, you will need to check the appropriate procedures listed in the reference manual that accompanied your version of the LOTUS 1-2-3 software.

GETTING STARTED

What You Need

You need the following to use TTCATS:

- MS-DOS, Version 2.1 or higher
- Lotus 1-2-3, Version 1A or later
- TTCATS program diskette
- IBM PC, XT, AT[2] or certified 1-2-3 compatible computer with at least 256KB of random access memory (RAM) and one floppy diskette drive
- 80-column monochrome or color monitor
- Printer (optional)
- Formatted, blank, double-sided, double-density, floppy diskette

Copying

Before using TTCATS, make at least one backup copy of the program diskette on the formatted, blank floppy diskette using the instructions provided in your DOS manual. Put the original TTCATS program diskette away and work with the copy.

How to Start

1. To start TTCATS, you must first have LOTUS 1-2-3 loaded and running on your computer with the initial worksheet screen showing (see sample below). The specific procedures required to get to this point will depend on how your computer system is configured.

a. For single diskette drive systems (e.g., Drive A), insert the LOTUS diskette in Drive A, type 123, and press ENTER to display the copyright message. Press any letter key, replace the LOTUS diskette with the TTCATS diskette when prompted to place Disk B in Drive A, and then press any letter key to display the initial LOTUS worksheet screen.

b. For double diskette drive systems (e.g., Drives A and B), insert the LOTUS diskette in Drive A and the TTCATS diskette in Drive B. At the A> prompt, type 123, press ENTER and then any letter key (when prompted) to display the initial work sheet screen.

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[2]IBM PC, XT, AT are registered trademarks of the International Business Machines Corporation

c. For hard disk systems with a single diskette drive (e.g., Drives A and C), have the C> prompt and LOTUS (sub)directory displayed on the screen (consult your LOTUS 123 reference manual for the procedures that will get you to this point).

Depending on the particular version of LOTUS 123 that you have, one of the following two procedures should provide access to the initial LOTUS worksheet screen.

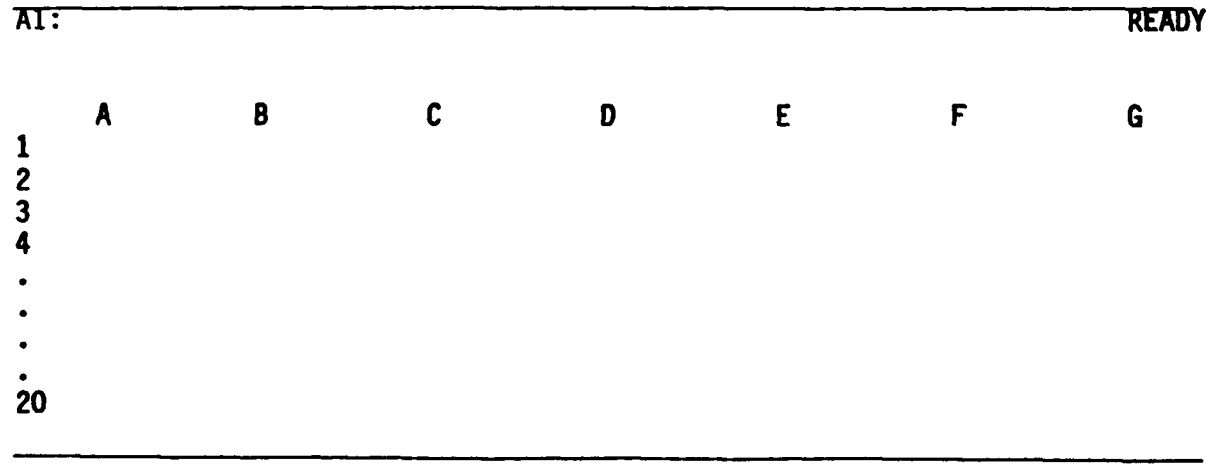
1. Place the TTCATS diskette in Drive A, type 123, press ENTER, and then press any letter key when prompted at the copyright screen. If this is unsuccessful, try #2.

2. Place the LOTUS 123 diskette in Drive A, type 123, press ENTER, and then press any letter key when prompted at the copyright screen. Replace the LOTUS diskette with the TTCATS diskette in Drive A when prompted to place Disk B into Drive A, and then press any letter key to display the initial LOTUS 123 worksheet screen. (Note: Consult your LOTUS 123 reference manual if neither of these two procedures works.)

The initial LOTUS worksheet screen shown below contains the following:

- A highlighted column along the left with the row numbers 1-20
- A highlighted horizontal bar near the top with the column letters A-G
- A highlighted rectangle, called the cell pointer, located where the column and bar intersect
- "A1:" at the upper left corner indicating the current column and row position of the cell pointer
- The mode indicator in the upper right corner with "READY" highlighted.

Sample Lotus 1-2-3 Initial Worksheet Screen



You should now be ready to load one of TTCATS' templates into your computer's memory. To load a template:

2. Press / to bring up the command menu, i.e., "Worksheet, Range.....Status."

3. Press F to bring up the file submenu, i.e., "Retrieve, Save,.....Directory."

4. Press R to retrieve a template file.

You should now see "Enter name of file to retrieve:" near the top of the screen along with the list of template names, e.g., CATCBT, CATPORT.

The first name on the list (i.e., CATCBT) should be highlighted. You can use the arrow keys to highlight other templates.

5. For now, **Select** (i.e., highlight) **CATCBT and Press ENTER**

The initial CATCBT screen will have all of the features of the initial LOTUS 1-2-3 worksheet screen plus the following:

- The top or "current cell" line will have "A1: 'Welcome to the Training Technology Cost Analysis Template for." A1 is the current cell location and "Welcome to the Training.....for" is the content of that cell.

- The mode indicator in the upper right corner will show "READY."

- The second "or edit" line will have a flashing cursor located just below "A1." In general, the edit line displays whatever you type for entry into the current cell.

- Inside the row/column matrix is an introductory message that identifies the template, in this case CATCBT, and provides brief instructions on how to use it.

USING TTCATS

Although we will be using CATCBT, the following instructions apply to all 7 templates found on the TTCATS program diskette.

1. Press ALT and h simultaneously and then **ENTER** to change the mode indicator from "READY" to "CMD READY."

This will take you directly to the **INPUT SECTION** screen (see sample below) of the template with the cell pointer highlighting the first cell (e.g., cell A26 for template CATCBT) for which your input is required.

Sample INPUT SECTION Screen (For CATCBT)

```
      A          B          C          D          E          F          G
23  INPUT SECTION:
24  Number of Workstations Needed:
25
26        500 TOTAL NUMBER OF TRAINEES PER COURSE ITERATION
27         50 NUMBER OF TRAINING SITES
28
29         10 Average number of trainees per site
30
31         40 DURATION OF TRAINING PER COURSE ITERATION (HRS)
32        400 TOTAL TIME EQUIPMENT WILL BE AVAILABLE FOR TRAINING (HRS)
33
34
35          1 Minimum number of workstations needed per site
36         10 Number of trainees each workstation can support
37              (Assuming maximum equipment usage)
38
39         50 Minimum total number of workstations needed
40
41
42
```

2. Enter the TOTAL NUMBER OF TRAINEES PER COURSE ITERATION (maximun of 8 digits without comma) you expect to participate in the training and Press **ENTER**. The number already in this cell is present only as an example.

Pressing ENTER does two things: it automatically moves you to the next cell for which your input is required (e.g., A27 for CATCBT) and it replaces the previous cell entry with the number you just typed. If you do not wish to change the cell entry, just Press ENTER and the cell pointer will move to the next input cell, leaving the previous cell's input unchanged. You may also use the arrow keys at any time to move to a cell and change its contents if you have second thoughts about an entry.

Pressing ENTER after using the arrow keys will take you back to where you left off.

3. **Continue** describing the distributed training system for which you wish costs to be calculated by **entering your input** in the cells identified by the cell pointer each time you press **ENTER.** If you wish to leave a cell entry unchanged, then just Press **ENTER.**

Only "entry" cells in rows of the **INPUT SECTION** with **upper-case letters** will accept your input. The values for "non-entry" cells in rows of the **INPUT SECTION** with **lower-case letters** are automatically calculated by the template on the basis of your previous input.

If, by mistake, you try to change the value of a "non-entry" cell, the computer will beep and display a "cell-protected" message in the lower left corner of the screen. At this point, the computer will only accept a press of the **ENTER** key. This will clear the cell-protected state, but also force you to press **ALT-h** and start over.

4. After you have entered your input into the last entry cell of the **INPUT SECTION**, the template will move you automatically to the first screen of the **OUTPUT SECTION** (see sample below) which shows the costs of delivering distributed training under the requirements indicated by your input. (You may wish to **press the right arrow key** to see the part of this screen that is out of view.) Costs are depicted in terms of dollars spent per trainee per hour per year (and various subsets thereof) and on an accumulated yearly basis. This screen also shows a tally of the number of trainees participating in the training program per year and on an accumulated yearly basis.

SAMPLE FIRST OUTPUT SCREEN (FOR CATCBT)

G212: **CMD READY**

	G	H	I	J	K
212		Costs For Computer-Based Training			
213					
214			1st yr	2nd yr	3rd yr
215	$/Year		$2,818,192	$1,169,340	$1,169,340
216	Total $ From Start		$2,818,192	$3,987,532	$5,156,872
217	Trainees/Year		2000	2000	2000
218	Total Trainees from Start		2000	4000	6000
219	Average $/Trainee From Start		$1,409	$997	$791
220	$/Trainee/Year		$1,409	$585	$585
221	Average $/Trainee/Hour From Start		$35	$25	$20
222	$/Trainee/Hour/Year		$35	$15	$15

5. **Press ENTER** to display the second screen of the **OUTPUT SECTION** (see sample below) which shows the yearly and accumulated breakdown of training costs by category. Again, **press the right arrow key** to view the rest of this screen.

SAMPLE SECOND OUTPUT SCREEN (FOR CATCBT)

G232: ' COST BREAKDOWN READY

	G	H	I	J	K
232	COST BREAKDOWN				
233			1st yr	2nd yr	3rd yr
234	ONE-TIME COSTS				
235	CBT Equipment		$1,248,852	$0	$0
236	CBT Software		$400,000	$0	$0
237	Communications Installation		$13,539	$0	$0
238					
239	RECURRING COSTS				
240	CBT Maintenance		$153,532	$153,532	$153,532
241	Communications Fees		$56,544	$56,544	$56,544
242					
243	USAGE COSTS				
244	Communications &		$959,264	$959,264	$959,264
245	Mainframe				
246					
247	Total		$2,831,731	$1,169,340	$1,169,340

6. Press ALT-h if you wish to start over and explore costs associated with another set of requirements (i.e., cell inputs). Because the results of a second analysis will replace those of the first, you might also want to print out your current results or save them to disk before making any new entries. Chapter 6 tells you how to print and save as well as exit the template.

PRINTING/SAVING/EXITING

Printing Results

You can print out your results in either of two ways:

1. Press ALT and p simultaneously at the **COST BREAKDOWN** screen of the **OUTPUT SECTION** to receive a printout of both your input and the resulting cost output. The printout will be dated (if you have the date set in your computer) and will identify the particular delivery method/equipment configuration to which the cost results pertain, e.g., CATCBT.

2. Press **Print Screen** to print out any screen currently in view.

Saving Results

You can save your results at any time by doing the following:

1. Press / to bring up the command menu

2. Press F to bring up the file submenu

3. Press S to request that the results (i.e., data) be saved.

You should now see "Enter save file name:" followed by the filename of the TTCATS template that you have loaded into the computer (in this case, CATCBT). Normally you will want to save under that filename. To do so:

4. Press **ENTER**

The program will check the floppy drive from which you originally loaded the template (e.g., CATCBT), notice a file by that name already exists, and ask you if you wish to cancel the "save" command or replace the file on the disk.

5. Press R to replace the file with the new results.

Exiting a Template

You can exit from any template at any time by doing the following:

1. Press / to bring up the command menu

2. Press Q to indicate that you wish to exit (quit)

3. Press Y to verify that you want to exit (quit)

Note: This should return you to the DOS prompt, e.g., A>. In some cases, however, it may return you to the LOTUS access program. If so, **Press E** to indicate your wish to exit, and then **Y** to verify it.

TEMPLATE MODIFICATION PROCEDURES

Because the costs for such things as hardware, software, maintenance, communications, and travel tend to vary over time, you may wish to modify the cell(s) in a template's DATA SECTION to better reflect current prices. The following procedures can be used to edit the contents of a cell.

A. Lifting Cell Protection

All cells in the DATA SECTION of each template are "protected" against accidental modification. This protection must be lifted before the contents of any cell can be edited. To lift protection on DATA SECTION cells (and those in the other sections as well),

1. Have the initial screen of the template displayed with the mode indicator showing "READY." (Do not press Alt-h)

2. **Press /** to display the command menu, e.g., Worksheet, Insert, Delete.....Status."

3. **Press W** (for Worksheet)

4. **Press G** (for Global)

5. **Press P** (for Protection)

6. **Press D** (for Disable)

B. Moving the Cell Pointer

7. **Move the cell pointer to the cell you wish to edit.** You can move in either of two ways:

   a. By pressing the arrow keys

   b. By going directly to the desired cell by performing the following steps:

      - **Press F5** (the LOTUS 1-2-3 GOTO Key)

      - **Type the cell location, e.g., A103, and press ENTER.** This will move the cell pointer directly to the cell corresponding to Column A and Row 103.

C. Editing a Cell

With the cell pointer located at the cell you want to edit,

8. **Type in the new number and press ENTER.** (This number will be

changed automatically to dollar format.)

D. **Resetting Cell Protection** (optional)

After you have finished editing, you may wish to reset the cell protection to prevent accidental modification. To do this,

9. **Press /** to display the command menu
10. **Press W** (for Worksheet)
11. **Press G** (for Global)
12. **Press P** (for Protection)
13. **Press E** (for Enable)
14. **Press ALT-h** to go back to the initial screen of the template

TEMPLATE FORMULAS AND ASSUMPTIONS

Formulas

Each TTCATS template uses formulas, located primarily in the CALCULATION and OUTPUT SECTIONS, to calculate costs on the basis of distributed training requirements you supply in the INPUT SECTION and price information contained in the DATA SECTION. To view these formulas, and thereby determine how various cost figures are derived, move the cell pointer (e.g., using the arrow keys) to any number or dollar figure located in the CALCULATION or OUTPUT SECTIONS of a template. The formula used to derive the figure will be displayed on the current cell line located at the top of your screen. If you are unfamiliar with LOTUS 1-2-3, consult your reference manual for information on how to translate formula notation.

Assumptions

Certain assumptions were made during the development of specific templates to simplify their usage. Because these assumptions may not become apparent from using the templates or from viewing their formulas, they are listed below under the template to which they apply. It is assumed that:

For CATCBT

1. A minicomputer or mainframe, if required for networking workstations, will be leased rather than purchased. No provision for purchase costs is included in the template. If you intend to purchase this equipment, then put a 0 in Cell A66 and add purchase costs in by hand.

2. Any network-based distributed training requiring a leased minicomputer or mainframe host will be provided via PLATO. To substitute another system for PLATO, e.g., TICCIT, change the system name in Cell A165 of the DATA SECTION and the associated hourly cost in Cell D165.

3. Workstations will be microcomputers, rather than terminals, to enable information uploading and downloading, and thereby minimize on-line communications costs.

4. The GRAPHIC INPUT SOURCE will be a mouse. If a different source is desired (e.g., lightpen), replace the input device name in Cell A104 and its associated price in Cell D104.

5. Telephone rates are for AT&T 800 service, domestic, in-state, Idaho. You will want to change these rates to reflect the specific rates pertaining to the geographical location over which your desired training will be delivered.

6. Setup and maintenance costs will each be 10% of initial equipment costs. To adjust this percentage, enter a number between 0.0 and 1.0 and the template will automatically convert it to a percentage.

For CATPORT

1. The cost of all peripheral equipment, except modems, for portable computers used by trainees is to be included in the total configuration price located at Cell E123.

2. See CATCBT #1.

3. See CATCBT #2.

4. See CATCBT #5.

4. See CATCBT #6.

For CATACC

1. Workstations are networked to a mainframe computer via telephone line rather than a cable-based Local Area Network (LAN). If LAN communication is desired, set telephone costs to 0 and add LAN costs in by hand.

2. A local telephone number (e.g., through TELENET) is available for accessing the computer network. (This may not always apply to trainees living in small towns)

3. The trainer's workstation will be a microcomputer.

4. See CATCBT #2.

5. See CATCBT #3.

6. See CATCBT #6.

For CATTRAVL

1. Per diem is calculated on the basis of full rather than quarter days.

For CATSAT

1. Origination site for training will employ a full-scale studio configuration.

2. Full-motion video will be used.

3. See CATCBT #6.

For CATMW

1. See CATCBT #2
2. See CATCBT #5.
3. See CATCBT #6.

For CATAUD

1. See CATCBT #5.
2. See CATCBT #6.

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APPENDIX A

CANDIDATE DISTRIBUTED TRAINING TECHNOLOGIES

Various technologies are available for delivering training to distributed locations. The following provides a description of those typically used to support synchronous and asynchronous delivery.

Synchronous vs Asynchronous Delivery

The first question to be answered when considering the use of distributed training technologies is whether trainer and trainee(s) must be present during training to ensure success. Synchronous delivery requires that both trainer and trainee physically meet at the same time while asynchronous delivery does not. In most distributed training situations, a decision about whether delivery will be synchronous or asynchronous is fundamental to determining the cast of supporting technologies.

In general, to deliver training synchronously one must rely heavily on communications technologies to support the long-distance, concurrent interactions that typically take place between trainer (i.e., at the origination site) and trainee (i.e., at the reception site). To deliver training asynchronously, in contrast, communications technologies may or may not be necessary, but usually computer-based (Kearsley, 1985) or "intelligent" technologies are required to make pedagogical decisions (i.e., instructional decisions traditionally made by the trainer). Figure 1 lists the various technologies typically used for synchronous and asynchronous delivery. Each is described below.

Technologies

Synchronous	Asynchronous
Audio Conferencing	Standalone CBT
Augmented Audio Conferencing	Portable
Video Conferencing	Interactive Videodisc
	Networked CBT
	Time-Sharing Systems
	Distributed Systems
	Computer Conferencing

Figure A-1. Candidate distributed training technologies.

Synchronous Technologies

In general, synchronous technologies support group- rather than individual-paced learning and rely heavily on communications technology.

Audio Conferencing. With audio conferencing, two or more remote sites are linked together by telephone. This allows a person at one site to be heard by those at another. Any verbal interaction or sound, subject to the limitations of telephonic transmission, can be transmitted with this technology. Thus, training that involves lecture, discussion, question and answer sessions, and so forth, can be conducted via audio conferencing

provided no visual information is required [see Fowler & Wackerbarth (1980) for more on the pro's and con's of audio conferencing].

Audio conferencing equipment is relatively common and inexpensive. If there is only one trainee per site, a standard telephone at each location is sufficient. If there is more than one trainee per site, then a speaker phone with microphone is required so that all trainees can participate. The multiple connection of several phone lines is made possible by a "bridging" device located at one of the sites or at the main switching computer of the telephone company. The bridge answers calls from each distributed site, connects them, and maintains the connection until the individual calls are terminated (Kearsley, 1985).

Augmented Audio Conferencing. Perhaps the most serious shortcoming of audio conferencing is its lack of visual capabilities. This limitation, however, can be overcome by augmentations in the form of visual adjuncts such as pictures, slides, movies, books, videotapes, etc., sent in advance of the conference. More sophisticated forms of visual augmentation use computers to exchange line drawings or graphics, much like the way in which a trainer might use a blackboard. Naturally, the kind of visual augmentation to be used determines the delivery requirements. Static form visual adjuncts sent in advance via mail or facsimile machine are less powerful because trainer and trainee are still limited to audio interaction (Parker, 1983). In contrast, dynamic, computer-supported video technology allows visual as well as audio interactions.

Static forms of augmentation merely require the equipment to produce these visuals and the ability to send them in advance of each training session. Dynamic forms require a computer and modem at each site. To support computer graphics capabilities, an input device (e.g., light pen), as well as software to coordinate data transfers are also required.

Video Conferencing. This technology allows both unidirectional (i.e., from origination to reception site) and more costly bidirectional transmission (Cross, 1982) of high-fidelity, video information ranging from freeze-frame to full-motion video. Full-motion video is capable of concurrent audio transmission, whereas less than full-motion technologies enable two-way video but no audio transmission. If sound is required, then audio conferencing must be used in conjunction with less than full-motion video conferencing.

Freeze-frame video transmission requires special equipment at both the origination and reception sites. This equipment codes video camera output at the origination site into signals appropriate for transmission over commercial telephone lines, and then decodes these signals at the reception site. As an alternative, freeze-frame video equipment can be replaced by a microcomputer with video digitizer.

Full-motion video is usually transmitted via television or microwave broadcast antenna. The signal is directly beamed or beamed up to satellite and back down again to the reception site. At this site, an antenna or dish with receive circuitry is required to generate a signal which is fed to a television set or monitor being viewed by the trainee. Full-motion video has the advantage of the highest quality visual transmission in real

time, but can be costly when attempting to link multiple sites (Parker, 1983). Freeze-frame video is less expensive, but requires more time for picture transmission (about 30-60 seconds per frame) than that required for full-motion video (Kearsley, 1985).

Asynchronous Technologies

Unlike synchronous delivery, asynchronous delivery does not require trainer and trainee to interact concurrently. In most settings, the technologies used for asynchronous delivery are computer-based and substitute for the human trainer. Thus, equipment configurations supporting an asynchronous delivery function are typically classified as "intelligent" systems.

Standalone CBT. With standalone CBT, an individual trainee interacts with a microcomputer workstation. The workstation is not connected to other workstations or to a central computer. Software for training (i.e., courseware) and performance data management is stored in magnetic form on either floppy or hard disk.

The basic equipment necessary for standalone CBT consists of a standard microcomputer workstation (i.e., microcomputer, monitor, and printer) capable of processing, displaying, and printing textual and numerical information. Depending on additional requirements, the workstation might also include peripheral hardware accessories and accompanying software to support the processing of both acoustical (e.g., speech) and graphic information, with the latter received through an input device such as a mouse, lightpen, or touch screen. Standalone workstations, therefore, provide flexibility because each can be equipped with the specific features or capabilities needed for a particular training application.

Two common variations of standalone CBT are:

1. Portable CBT. The main feature of this variation is that the microcomputer is portable, and therefore, can be used at a variety of locations. Typically the peripheral equipment is held to a minimum to ensure portability. The monitor is usually built in while a printer and extra disk drives are either built in, attached peripherally, or omitted altogether.

2. Interactive Videodisc-Based CBT. Although interactive videodisc is just peripheral equipment added to basic standalone CBT, its substantial capabilities deserve special mention. With interactive videodisc technology, high-fidelity video images or motion sequences can be displayed and then augmented by superimposed computer text and graphics, thereby increasing the realism of the CBT environment.

Equipment requirements include a videodisc controller interface for the computer and a videodisc player with an interface of its own. About an hour of continuous video or 50,000 single-frame pictures can be stored in analog or digital form on one 12-in videodisc. Currently, the cost of developing and producing a videodisc ranges from $35,000 to $100,000 per hour of instruction (Johnston, 1985).

Two soon-to-be-realized alternatives to the standard 12-in videodisc are the 5.25-in Compact Disk-Read Only Memory (CD-ROM) and the Compact Disc-Interactive (CD-I). Besides being smaller in size than the standard videodisc, both CD-ROM and CD-I can store larger quantities of information, e.g., whole encyclopedias on a single disk, in digitized format which can be read by a CD player similar to that used for playing stereo music. While both kinds of discs have tremendous storage capabilities, CD-I will have a greater range of training applications because of its ability to display video stills and animated graphics (Brewer, 1987).

Networked CBT. This delivery variation occurs wherever individual workstations are linked with each other and/or a central mainframe or minicomputer to form a network.

Basically two forms of networked CBT exist.

1. Time-Sharing Systems. Historically, CBT systems have been based on time-sharing configurations involving large, central, mainframe computers and terminals that share the processing, offline storage (i.e., disk drives), and input/output peripherals (e.g., printers) of the mainframe. Sharing takes place via a communications network that may require remote transmissions over long distances, e.g., via telephone lines, or local transmissions, e.g., via coaxial or fiber-optic cables (Dean, 1986).

Because of the presence of a mainframe computer, and its powerful processing and storage capabilities, relatively simple and inexpensive terminals (i.e., "unintelligent" terminals) can be used to perform highly sophisticated tasks and can be added to the system at a relatively low per-terminal cost. Of course, more equipment is also required by a time-sharing system than by a standalone system. Additional equipment includes a mainframe or minicomputer for storage and information processing, communications interfaces for the terminals, and cables or telephone lines to connect terminals with the central computer.

Aside from the attractive features of time-sharing systems, they have limitations related to saturation and reliability that do not apply to standalone systems. Saturation occurs when too many terminals are in use simultaneously, thereby degrading system performance in terms of unacceptable response delays. Reliability can be a problem because when the mainframe fails for any reason, the entire terminal network it supports is affected (Kearsley, 1983).

2. Distributed Systems. The distributed CBT system represents a marriage of time-sharing and standalone capabilities. With a distributed system, microcomputer workstations are networked together as well as to a central mainframe or minicomputer. Because individual workstations contain their own microcomputer, rather than terminals, they can function in a standalone mode as well as share the processing or storage capabilities of other workstations or the central computer. Unlike time-sharing systems, the failure of one workstation or the mainframe does not prevent the functioning of the other workstations in the network.

The equipment required for distributed systems is similar to that required for time-sharing systems except that the former requires more expensive workstations, i.e., microcomputers, rather than terminals. The extra cost, however, provides the flexibility that is sometimes needed for the conduct of effective training.

Asynchronous Computer Conferencing. Asynchronous computer conferencing is unlike the other asynchronous technologies in that it enables trainees to communicate with a human trainer, and one another, at different times and from different locations via computer over existing telephonic networks. The concept is similar to an elaborate electronic mail system whereby participants enter their communications on computers that are connected by telephone to a host or central computer which stores, retrieves, and organizes the messages.

The system is set up such that each participant can access communications sent by all other participants of the network, thereby simulating actual, real-time or delayed discussion. Asynchronous computer conferencing, therefore, provides a mechanism for establishing a simulated, long-distance, electronic classroom wherein the trainer can conduct discussion, assign and correct homework, answer questions, give tests, and provide the feedback necessary for effective learning, all while trainees participate at their own pace and at times and locations convenient to them. Unlike other computer-based delivery technologies mentioned above, asynchronous computer conferencing uses the computer primarily for communication and management purposes and leaves pedagogical decision making in the hands of the trainer.

In addition to the need for a central computer with a sufficient number of input ports as well as modems and software to manage message traffic, the trainer and each trainee must have their own microcomputer (portable or desktop), monitor, modem and communications software to effect connection with the main computer. The central computer can be located anywhere that a telephone connection can be established between it and the other computers.